BOTANY

Cytology and Mutation.— Immediately after the rediscovery of Mendel's law and the publication of DeVries's great work on mutation, cytologists began seeking for some basis for these phenomena in the organization of the germ cells. The most recent contribution to the literature of this subject is a paper by Gates[1] on *Œnothera Lamarckiana* and *O. lata.*

The author finds that the regular abortion of the pollen in *Œnothera lata* is not due to the filling of the anther cavity or loculus by an ingrowth of its lining (the tapetum) as described by Pohl, but to some other agency the nature of which is not yet explained. Pollen development may proceed to the formation of the tetrads, but degeneration of both the mother cells and the tapetum frequently begins in the resting stage or in the prophase of the first mitosis. If the tapetal cells always degenerated before the pollen mother cells, we might conclude that the failure of the former to secrete nutriment for the pollen was the immediate cause of sterility. But this is not always the case for the degeneration of the pollen mother cells may precede that of the tapetum. The writer is inclined to accept the hypothesis that the maternal and the paternal chromatin remain separate in the somatic cells, and also in the germ cells until maturation approaches. Then the intimate union which occurs during synapsis may lead to incompatibilities between the plasms and to the more or less complete failure of further development.

A second point of interest is the demonstration of peculiar chromosomes, called "heterochromosomes." They arise in *O. lata* in the prophase after synapsis by the cutting off of a portion or loop of the spireme thread before the remainder breaks up into chromosomes. A cell may contain one or two of these bodies which appear as large rings, usually seen in the cytoplasm near the spindle. They do not divide but become smaller and probably disappear at the end of the first mitosis. In the *O. Lamarckiana* hybrid these bodies also occur. The author thinks that they represent discarded chromosomes and are, perhaps, a means of lessening the number of chromosomes in certain

[1] Gates, R. R. Pollen development in hybrids of *Œnothera lata* × *O. Lamarckiana*, and its relation to mutation. *Bot. Gaz.*, 1907, vol. 43, pp. 81–115, pl. 2–4.

germ cells. Some mother cells do not contain them, but it could not be demonstrated that these have fewer ordinary chromosomes than the others. The number of chromosomes in *O. lata* is fourteen; in the hybrid with *O. Lamarckiana* it is "probably twenty"; and in pure *O. Lamarckiana* the number, as yet undetermined, is thought to vary. Since a different number of chromosomes in closely related species has apparently never before been recorded, these observations if they are verified by further investigations are of great interest. The author dismisses the idea that *O. Lamarckiana* is itself a hybrid, but this also is an important subject for further study. He concludes that the mutations of *O. Lamarckiana* probably arise during the reduction divisions, and that the pollen grains which give rise to mutants may differ in their chromatin morphology from the ordinary pollen of the plant.

J. A. HARRIS

Variation and Differentiation.— Dr. Pearl has recently published an exhaustive study of the intra-individual variation and differentiation in Ceratophyllum.[1] The purpose of the author was "to work out as exactly and completely as possible for a particular organism the laws according to which post-embryonic differentiation and growth occur." The characters considered are (a) the number of leaves per whorl; (b) the position of the whorl on the plant; (c) the size of the various divisions of the plant; and (d) the position of the branches. It is found that the mean number of leaves per whorl is greatest on the main stem and decreases on the primary, secondary, tertiary and quaternary branches. The variability — measured by both the standard deviation and the cœfficient of variation, on the other hand, increases on the branches of the first and second order to fall again on those of the third and fourth order. The skewness also seems to increase in the negative direction from the main stem outward but the shortness of the material does not permit of the determination of this point by analytical methods beyond the secondary branches. A marked correlation is found between the position of the whorl on the stem and the number of leaves. The number of leaves increases from the base to the tip of the axis but the increase cannot be represented by the slope of a straight line — in biometric terminology, regression is not linear — or by a parabola. The increase is, however,

[1] Pearl, R. Variation and Differentiation in Ceratophyllum. *Carnegie Institution of Washington*, 1907, Publ. 58, 136 pp., 26 figs., 2 pl.